KnowledgeLink Update: Just-in-time Context-sensitive Information Retrieval

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Background
Medical knowledge expands at a pace that makes it impossible for the individual clinician to keep up, especially for medications. Medication-related queries are the most common type of query that typically go unanswered during the course of providing care.[1] Unanswered questions may result in errors, as found in one study evaluating systems failures associated with adverse drug events. This study found that better information might have prevented half of serious medication errors, and that lack of drug-specific knowledge accounted for the single largest proportion of these events (29%).[2] While this information was available somewhere (either on paper or electronically), it was not at the providers' fingertips. Information technology should anticipate clinicians' needs, and bring the information they require to the point of care. For this purpose, we developed an application extender called KnowledgeLink, which provides "just-in-time" context-sensitive information retrieval for drug-related queries.

Methods
A proof-of-concept prototype was presented at AMIA 1999.[3] Briefly, KnowledgeLink embeds within Partners HealthCare Systems' electronic medical record (EMR) "look-up" buttons () wherever medications appear. The button activates a URL to one of two web-based information resources, MICROMEDEX® or SKOLAR MD, both of which have an API for non-GUI-dependent searching. The queries are context-sensitive in that the drug is automatically inferred using simple text-based parsing rules and inserted into the URL. The results of the query are displayed in a new window, which upon termination returns the user to exactly the point left in the EMR. In this way, with as few as 2 mouse-clicks, the answers to queries likely to arise while prescribing or reviewing medications can be obtained exactly at the time such queries arise and with minimal interruption to the activity itself.

KnowledgeLink was launched in January 2003. No formal introduction or training was provided. Approximately every 5th use, the clinician was asked about the question in mind, whether KnowledgeLink provided the answer, and how the answer affected patient management.

Results
In the first two months, the application was used 1335 times by 206 health care workers to look-up information about 584 drugs for 927 patients. Usage varied considerably, with the average user accessing KnowledgeLink about once per week (range 0.1-18.9). Similarly, the queries per medication also varied (average 2.3, range 1-18). Most users were physicians (60%) or nurses (39%), with others including midwives, physician assistants, and other types of health care workers.

Of 134 queries surveyed, 43 responses were received. These medication queries were most often about dosing (33%), side effects (21%), drug interactions (12%), general information (12%), indications (9%), or pregnancy (5%). Thirty-two (74%) KnowledgeLink queries resulted in answers. These answers supported a previously made medical decision 19 times (59%), and altered or impacted a medical decision 8 times (25%). In general, the feedback has been extremely positive.

Conclusion
KnowledgeLink provides useful "just-in-time" context-sensitive drug information that confirms a medical decision 59% of the time and alters or significantly impacts a medical decision 25% of the time. The user interface is simple and easy to learn without training. About 40% of usage is by non-physicians.

References
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